

Tomography at 5BMC: background, status, and future plans

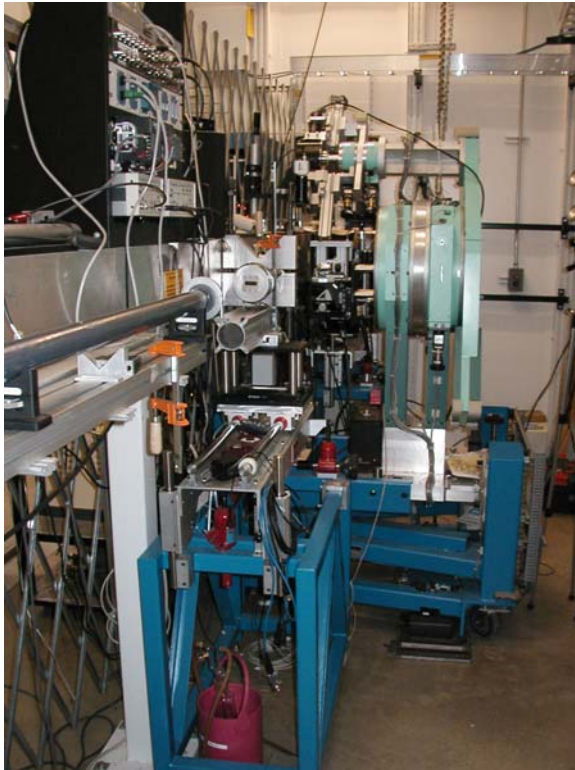
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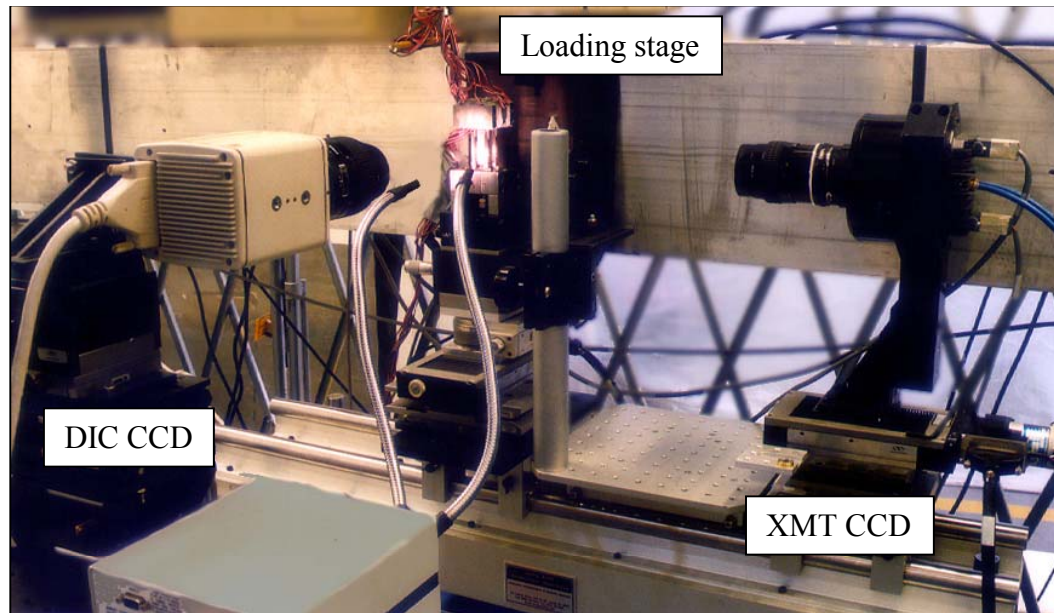
Northwestern University

5BMC Hutch

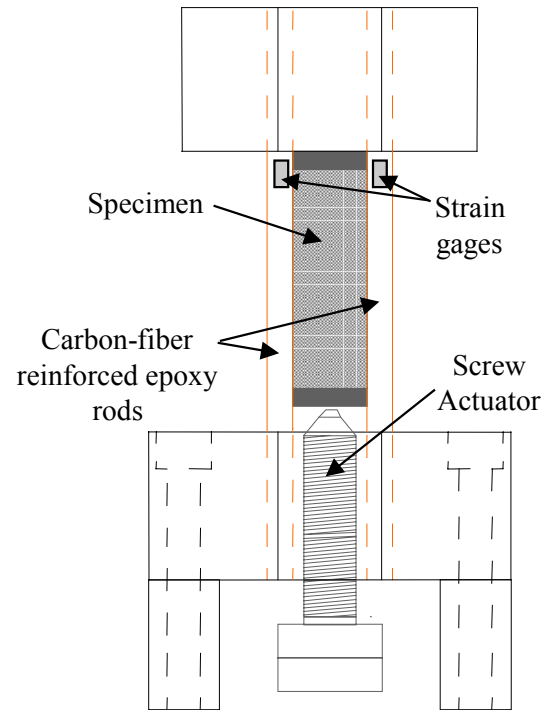


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Original setup



Tomography of Concrete



Concrete Data

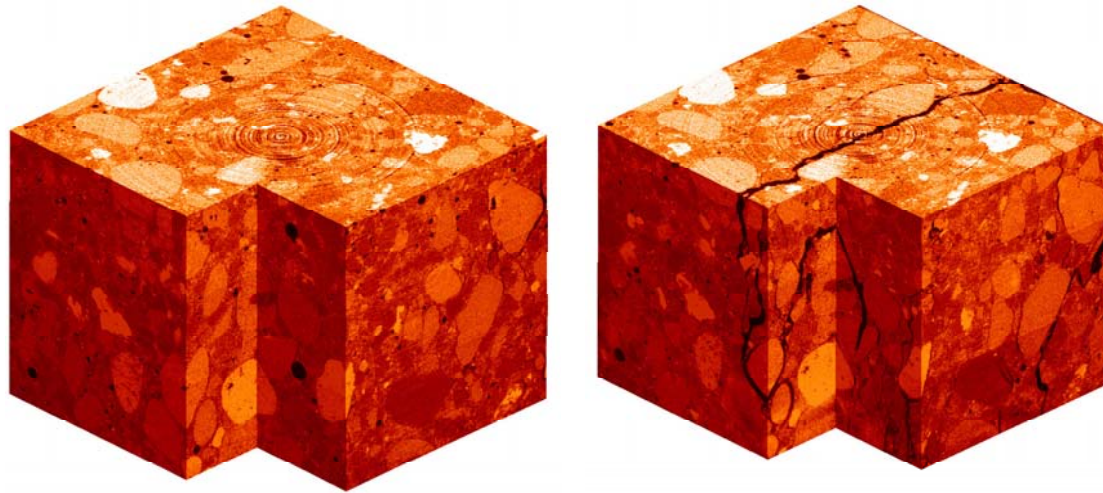
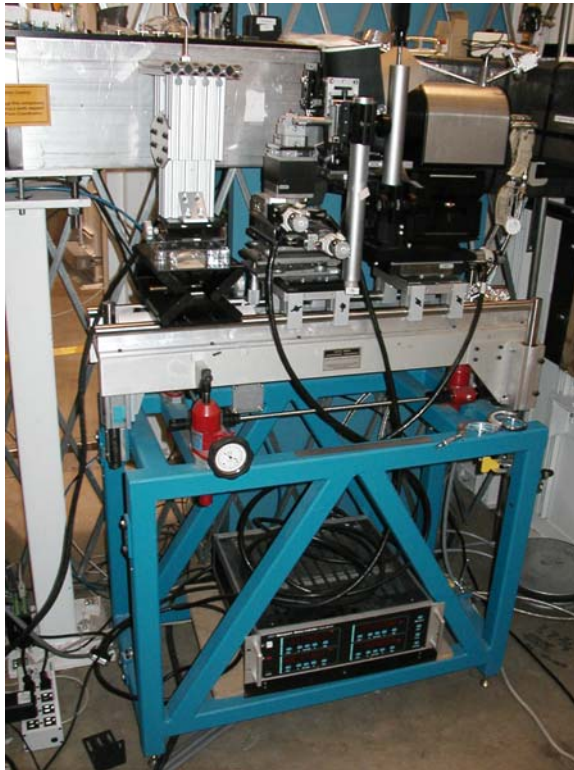


Fig. 13. Reconstructed volume at 92% of peak load and 13% of peak load (post-peak) for sand aggregate

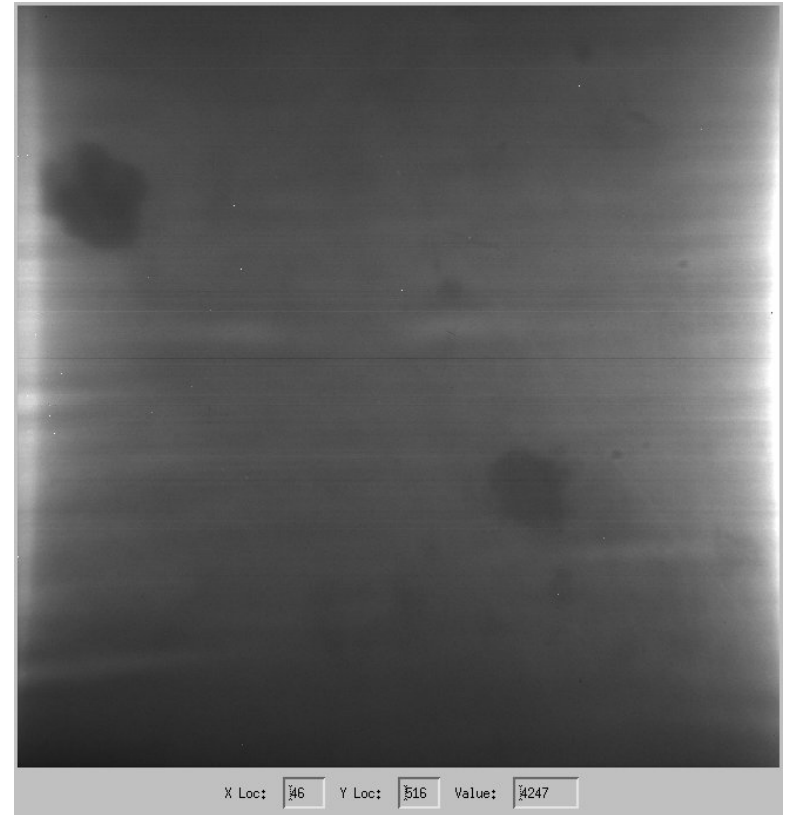
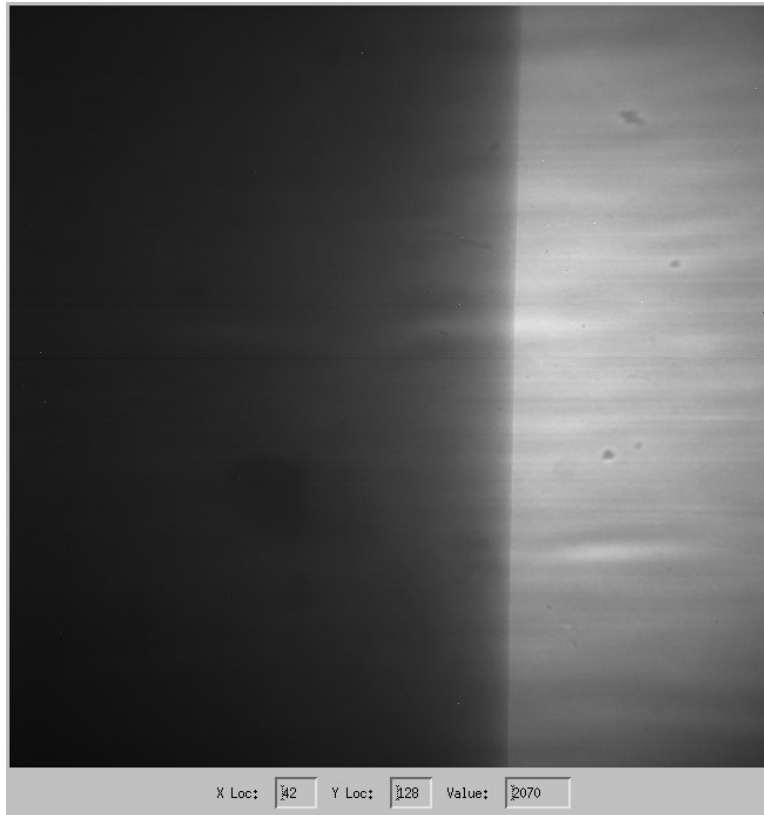
Current Tomography Setup



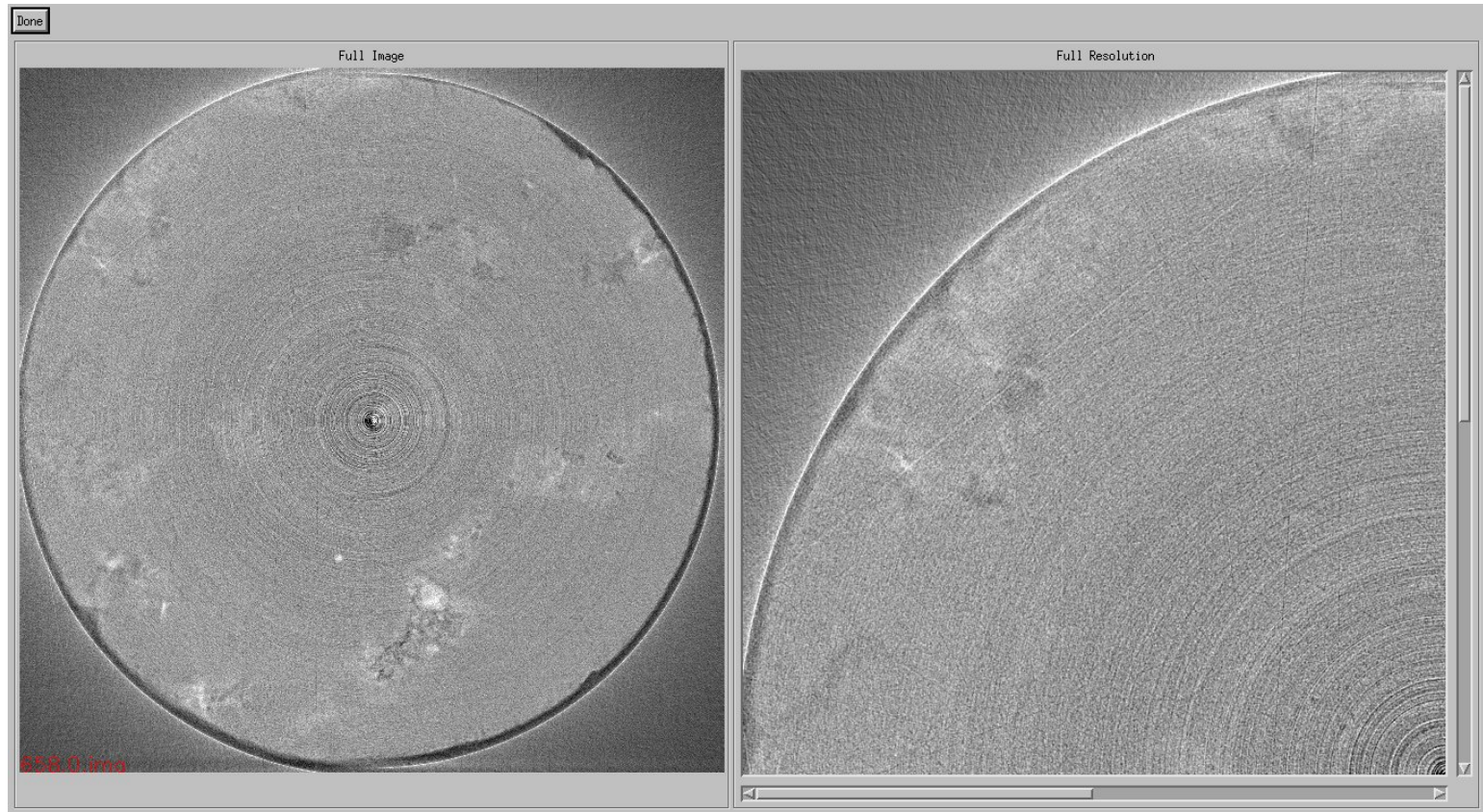
Control Software

Master Directory to Store Data on CCD Computer:	/d2/gup/jones/rom-99-14	Scan Running Flag :	0
Data Directory to Store Data on CCD Computer:	rom99142b	Scan Abort Flag :	0
Start Angle(degrees):	0.0	Scan Pause Flag :	0
Stop Angle (degrees):	180.0	Current Data File Number :	2000
Angular Increment (degrees):	0.09	Current Data File Name :	/rom-99-14/rom99142b/s
Exposure Time (ms):	20000	Current i0 File Number :	400
Start X for Subframe (pixels):	1	Current i0 File Name :	/rom-99-14/rom99142b/s
X Length for Subframe (pixels) :	1299	Current Rotation Angle :	179.91
Start Y for Subframe (pixels):	1	Total Number of Files:	2400
Y Length for Subframe (pixels) :	1299	Bad Frame :	0
Sample Position for Data Frames (mm) :	12.52	Reset Bad Frame Flag	
Sample Position for I0 Frames (mm) :	7.0	<input type="checkbox"/> Beam Dump Restart <input checked="" type="checkbox"/> Beam Dump Continue	
I0 Frame Collection Interval :	5	Camera Translation Position :	+0.8
Experimenter :	Keane	New Camera Translation Position:	0.8
Sample ID :	rom-99-14, #2, 10x lens	Update Camera Translation	
Start Scan		Move Camera Translation to New Value	
Abort Scan		Sample Rotation Position :	+0.0
Pause Scan		New Sample Rotation Position:	0
Resume Scan		Update Sample Rotation	
Test darkfile name (and path) :	/tmp/dark	Move Sample Rotation to New Value	
Test image name (and path):	/tmp/test	Sample Translation Position :	+12.52
Take test dark frame		Sample Translation Position :	12.52
Take test image		Update Sample Translation	
Update camera settings		Move Sample Translation to New Value	

Typical Images



Processing Data



Current Setup

Beamline

- **Si(111) crystals: 7 keV to > 40 keV, shared with powder**
- **Controls**
 - TK based graphical user interface
 - IDL for image analysis/viewing
 - Newport stages for sample motion, focussing

Roper Camera

- **Crotiger cooling**
- **1300x1340, 24 micron pixels, 16 bit readout, 1 Mhz**

Reconstruction

- CBREC from Mayo clinic
- Parallelized by John Quintana: 10+ node linux cluster

Future Plans

Beamline

- White beam into hutch, multilayer mono

Instrument

- New optics: better projection onto large CCD
- New high precision Newport stages: translate, rotate, height adjust
- Robot for sample changing (similar to sector 2)
- X-ray magnification post sample?

Reconstruction

- Use of non-FBP algorithm?

Acknowledgements

- John Dunsmuir, Kevin D’Amico: Exxon
- Brian Stephenson: IBM (now ANL)
- Paul Thomas: Mayo (CBREC program)
- John Quintana: DND-CAT (control programs and parallelizing CBREC)
- John Lawler, Surendra Shah: Northwestern (concrete data)

Outline

- **Background**
 - Keane post-doc at IBM: work at X2B
- **Initial XMT setup at 5BMC**
 - Camera details
 - Some experiments
- **Current setup**
 - Beamline characteristics
 - New Roper camera
 - Experimental setup and control
 - Reconstruction procedures
- **Future plans**
 - New precision stages
 - New light optics
- **Issues for discussion**
 - Exxon patent issues
 - Basis for common user interface